DOCUMENT RESUME

ED 176 881 PS 010 908

AUTHOR Bohlin, Gunilla; And Others
TITLE Early Individuality: Dimensions in Infant Behavior. Uppsala Psychological Reports, No. 248.
INSTITUTION Swedish Council for Research in the Humanities and Social Sciences, Stockholm.
PUB DATE 79
NOTE 35p.

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Age Differences; *Factor Analysis; Foreign Countries; Identification; *Individual Differences; *Infant Behavior; *Infants; *Personality
IDENTIFIERS *Sweden (Uppsala)

ABSTRACT

The purpose of this study was to apply factor analysis techniques to delineate dimensions of early infant behavior and to establish categories of functioning which can be seen as a source of individuality in early childhood. Data about the behavior of 791 infants in two age groups (11-25 weeks and 26-41 weeks) were obtained using a questionnaire answered by parents. Separate analysis and cross-validation procedures were used on the data from each sample. For both samples factors interpretable as broad behavioral dimensions were obtained. The preferred solutions for the two age groups were compared and judged to be similar enough to warrant a combination of the two samples. The preferred solution for the combined sample was an orthogonal 7-factor solution accounting for about a third of the total variance. At least five of the factors could be interpreted as broad behavioral dimensions and were named Intensity/Activity, Regularity, Approach-Withdrawal, Sensory Sensitivity, and Attentiveness. (Author/MP)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED176881

U S DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

UPPSALA PSYCHOLOGICAL REPORTS
No. 248, 1979

EARLY INDIVIDUALITY: DIMENSIONS IN INFANT BEHAVIOR

Gunilla Bohlin, Berit Hagekull, and Karin Lindhagen

University of Uppsala, Sweden

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Berit Hagekull
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Please address communications
about this prepublication to:
Department of Psychology
Box 227
S-751 04 UPPSALA, Sweden

PS 010908

ABSTRACT

The purpose of the study was to delineate dimensions of functioning in infant behavior by using factor analytic procedures. Data about the behavior of infants in two age groups were obtained using a questionnaire answered by parents. Separate analyses and cross-validation procedures were performed on data from the younger (11-25 weeks; N=381) and the older (26-41 weeks; N=410) sample. For both samples factors interpretable as broad behavioral dimensions were obtained. The preferred solutions for the two age groups were compared and judged to be similar enough to warrant a combination of the two samples. The preferred solution for the combined sample was an orthogonal 7-factor solution accounting for about a third of the total variance. At least five of the factors could be interpreted as broad behavioral dimensions and were named Intensity/Activity, Regularity, Approach-Withdrawal, Sensory Sensitivity, and Attentiveness.

Early Individuality: Dimensions in Infant Behavior

Recent years have witnessed an increased concern about individual differences in child development (Stone, Smith, & Murphy, 1974). The importance of such differences for later development and for the mother-infant interaction has been clearly recognized (Korner, 1971; Schaffer, 1977). In this context two somewhat different strategies have been followed in approaching the question of individual differences. Many studies have focused on a priori defined single areas of functioning, e.g. activity level (Fries, 1944), cuddliness (Schaffer & Emerson, 1964), attentional behavior (Kagan, 1970), spontaneous and reflex behaviors (Korner, 1969). In the alternative approach the primary intention has been to delineate dimensions of individual differences in the total behavioral repertoire of infants (e.g. Bell, Weller, & Waldrop, 1975; Escalona, 1968; Thomas, Chess, Birch, Hertzig, & Korn, 1963). One of the first and probably one on of the most influential attempts within this framework has been made in The New York Longitudinal Study (NYLS) (see Thomas & Chess, 1977, for an extensive review).

To obtain data about early individuality, Thomas and coworkers relied mainly on parental interviews, commencing when the child was about three months old and repeated regularly. They were interested in delineating categories of functioning or temperamental dimensions responsible for early individual differences in behavior. Data from the interviews contained descriptions of objective behaviors in specific situations rather than global judgements about inferred states and traits of the child. These behavioral descriptions covered a wide range of daily

activities and were linked to the environmental context by detailed descriptions of the situation and other persons behavior and responses to the child. Data were analyzed by an inductive content analysis through which nine dimensions of temperament were established. These nine dimensions were named Activity Level, Rhythmicity, Approach or Withdrawal, Adaptability, Threshold of Responsiveness, Intensity of Reaction, Quality of Mood, Distractibility, and Attention Span and Persistence.

The work by Thomas and coworkers unquestionably constitutes a great contribution to the understanding of individuality in early childhood. However, with respect to the question of dimensionality of infant behavior the subjective method used in identifying the behavioral dimensions leaves their answer equivocal. There is nothing but intuition to guarantee that the behaviors categorized together should be regarded as measures of the same more general behavioral dimension, or that all nine categories should in fact be regarded as separate dimensions. As pointed out by Bell et al. (1975) a satisfactory grouping of behaviors should be based on actual evidence of interrelations.

Factor analytic procedures have been used to identify dimensions of temperament of preschool children in a few studies. Similarities between the NYLS dimensions and factor structures obtained in these studies can be seen, although not all of the NYLS dimensions are reflected in any one study. Besides, the content of several NYLS dimensions is often mirrored in a single factor. Using items derived from the NYLS interview protocols Rowe and Plomin (1977) obtained a direct replication of the original NYLS dimension of Attention span and Persistence and that of Distractibility, and a somewhat narrower Rhythmicity factor. When items derived from the Buss and Plomin (1975) temperament theory of personality development were added, a factor similar in content to the NYLS factor

Activity Level was also obtained. The four dimensions found by Garside, Birch, Scott, Chambers, Kelvin, Tweddle and Barber (1975) can be interpreted as reflecting seven of the nine NYLS dimensions. Cohen, Dibble, and Grawe (1977) do not make any reference to the NYLS but at least two of their dimensions (Attention span and Activity) can be seen as equivalents to NYLS categories. In examing various age groups, Chamberlain (1977) found withdrawing and approaching patterns of behavior as well as Activity and Attention Span factors in a couple of age groups. When comparing these different studies it should be noted that the NYLS dimensions were originally established for infants under two years of age (Thomas et al., 1963), whereas the factor analytic studies mentioned above all employed older children, average age being around three to five years. There might exist developmental changes in the dimensionality of the behavioral repertoire, so that early dimensions merge and new dimensions appear (cf. Garside et al., 1975). The implications of the discrepancies between the dimensions found in the factor analytic studies and those of the NYLS for the conceptualization of the structure of individual differences are thus obscured by the use of different age groups in obtaining the dimensions.

The intention of the present study was to apply factor analytic techniques to delineate dimensions of early infant behavior and thus to establish categories of functioning which can be seen as a source of individuality in early childhood. Theoretical and methodological considerations emanating from the NYLS (cf. Thomas et al., 1963, 1968, 1977) constituted a starting point for this endeavor.

PILOT STUDY

As an alternative to the interview method used in the NYLS, Carey (1970) developed the Infant Temperament Questionnaire (ITQ), designed to represent the interview material gathered within the NYLS and to yield scores on the nine NYLS dimensions. The ITQ consists of 70 statements intended to cover the total spectrum of behavior of infants aged 3 1/2 to 8 months. The items describe specific behavior of the infant in specific situations and have three response alternatives.

The aim of the present pilot study was to use the ITQ as an initial pool of items in the course of investigating the dimensionality of behavior of infants in different age groups.

Method

The ITQ was translated into Swedish and sent to the parents of all infants born during a certain month in the commune of Uppsala. The sample consisted of 164 infants, 3 to 4 months of age. The parents were asked to indicate for each item which response alternative described their child most correctly. It was emphasized that no answer was right or wrong, good or bad. The parents were also encouraged to write down their reasons for not answering a specific item, to criticize formulations, etc. Three reminders were sent at weekly intervals.

Results

The questionnaire was returned by 128 parents, which yields a response frequency of 78%.

Before applying factor analytic methods to the data, 11 of the 70 items in the questionnaire were discarded because of absolute response frequencies less than 100. These items were conditional, concerned situations many infants had not experienced (e.g. illness), or described behaviors that many children were too young to exhibit (e.g. reaching

and grasping).

The remaining 59 items were factor analyzed by the method of principal factoring with units in the diagonals using a subprogram in the Statistical Package for the Social Sciences (Nie, Hull, Jenkins, Steinbrenner, & Bent, 1975). Classical factor analysis could not be applied since the determinant of the matrix was too small, probably due to few scale points and skewed distributions. Oblique and orthogonal rotations with 5 to 11 factors were tried. In interpreting the factors only factor loadings $\geq .35$ were considered. Generally, orthogonal rotations were more interpretable than oblique ones. The orthogonal 9-factor solution, accounting for 44.4% of the variance, was chosen as the most informative and theoretically meaningful one.

In the interpretation of the factors it appeared that six of them (factors 2 - 7) could reasonably well be interpreted in terms of broad behavioral dimensions. Factor 2 was composed of items describing intensity and activity aspects of behavior. All the items of factor 3 dealt with the regularity of various behaviors. The common aspect of the behaviors of factor 4 appeared to be the recognition of novelty in the environmental stimulation. The sixth factor concerned the general mood of the infant. Factor 7 seemed to represent the tendency to reject or accept situations that are new to the infant.

A comparison in terms of content of the obtained factors with the NYLS dimensions indicated that six of the NYLS dimensions were represented in four of the obtained factors. Thus, the dimensions of Intensity of Reactions and Activity Level were represented in factor 2, the Rhythmicity and Mood dimensions were mirrored in factors 3 and 6 respectively, and factor 7 seemed to tap the content of the Adaptability and Approach-Withdrawal dimensions.

However, in spite of the similarities in content, the actual allocation of items in specific dimensions did not always show perfect correspondence between the two studies. Factors 6 and 7 contained items from NYLS dimensions, other than their proposed equivalents. It should perhaps also be noted that serveral items which according to Carey (1970) belonged to the Activity, Intensity, Mood, Adaptability and Approach-Withdrawal dimensions did not load in the corresponding factor.

Three factors were not considered interpretable in terms of a general behavioral tendency, Factors 1 and 8 each concerned behaviors in a specific situation, i.e. reactions to wet and soiled diapers and to various aspects of the feeding situation. Factor 9, finally, contained several different situations, but a common behavioral tendency was not easily discerned.

In conclusion, the results indicated that factor analysis could be fruitfully used on questionnaire data to identify dimensions of infant behavior.

MAIN STUDY

Method

Revision of the questionnaire

For further development of the questionnaire only those items that had been factor analyzed in the pilot study were considered. Of these 59 items, 16 were excluded because of not satisfying the criterion of loading $\geq .35$ in any of the six factors regarded as general behavioral dimensions in the pilot study. Another eight items were discarded because of being similar in content to other questions.

The remaining 35 items were included in the revised version of the questionnaire. In the cases where comments given by parents in the pilot study indicated that an item was confusing or inappropriate in some

some way, the item was reformulated. Finally, new items were added to the inventory with the main intention of achieving a more complete description of behavioral individuality. To construct the new items, information was gathered from interviews with six parents about behaviors and situations in the life of their infants that were not covered by the questions in the original inventory. In this way, 19 new items were formulated to give a total of 54 items in the revised questionnaire.

To increase the possibilities of applying classical factor analytic methods to the data, it was considered desirable to change the number of response alternatives from three to five. Three different designs of the response scale, including the one used in the pilot study, were tested on six parents. The parents all agreed on selecting a scale with five distinct response categories as the best alternative. In this response scale, only the two end categories were verbally defined. For example, the two end categories of item 40 consist of the following statements, "The first reaction, when the child meets an adult stranger, is positive (laughs, smiles)," and "The first reaction of the child to an adult stranger is negative (cries, whimpers)." The parents were also instructed how to mark variable or no overt reactions in one of the three middle categories.

In summary, the revised version of the inventory included 54 items, intended to cover the total spectrum of situations encountered by most Swedish infants, aged 3 to 9 months. The response scale had five distinct categories with verbal definitions of the end alternatives.

Samples

The revised inventory was mailed to 514 parents of children 3 to 4 months old, and to 578 parents with children aged 6 to 7 months. The two samples were recruited from the official records of children born in Uppsala county; all children born during certain months were

selected. To increase the response frequency, three reminders, each separated by two weeks, were sent by mail. The final response frequency achieved was 68.9% for the younger sample and 75.6% for the older sample.

The actual age of each infant at the date the questionnaire was answered was calculated. Because of the delay between mailing the inventory and date of answering, some children in the younger sample became old enough to belong to the older sample. Thus, the samples were redefined; the younger sample eventually consited of 381 infants, aged 11 to 25 weeks, and the older sample consisted of 410 infants, 26 to 41 weeks old.

Factor analyses

Each item was given a score from 1 to 5. The product moment correlation was used as covariate measure and factor analyses were performed with a subprogram within the Statistical Package for the Social Sciences (Nie et al., 1975). For exploratory analyses factors were extracted by means of the principal factoring method, using an iteration process to estimate communalities. The extracted factors were orthogonally rotated according to the varimax criterion and obliquely rotated according to the direct quartimin criterion. For confirmatory analyses orthogonal procrustean transformation were used. By this method a factor matrix is rotated to approximately fit a target matrix (Gorsuch, 1974). In interpreting the factors only items with loadings $\geq$ .30 were considered.

Results

Comparison of orthogonal and oblique solutions

To decide the number of factors to be extracted the scree test (Gorsuch, 1974) was applied to both samples. This test indicated that extraction of five or six factors would be optimal. Following the line of reasoning of Cattell and Cattell

(ref. in Gorsuch, 1974), a few extra factors were extracted in order to ascertain that all common factors would be found. It was assumed that any trivial factors would subsequently be identified through the cross-validation procedures. Therefore, solutions with seven and eight extracted factors were tried initially. The obtained structures were obliquely as well as orthogonally rotated.

For both samples the orthogonal rotations yielded simpler solutions than the oblique ones in terms of hyperplane count (proportion of loadings $<\pm.10$) and number of variables loading in more than one factor. For the younger sample, the hyperplane counts were 59% for the two orthogonal solutions, whereas the counts were 48% and 50% in the oblique solutions. Three variables had loadings $\geq\pm.30$ in more than one factor in each of the two orthogonal solutions, whereas this number was increased to 8 and 10 for the oblique solutions. For the older sample, the orthogonal 7- and 8-factor solutions yielded a hyperplane count of 59% and 62% respectively. Corresponding values for the oblique solutions were 39% and 47%. The number of variables with multiple loadings was two in the orthogonal solutions and three and six in the oblique ones.

A closer comparison of the oblique and orthogonal solutions for the two samples showed the factors to be stable across method of rotation. The general pattern was that virtually all of the items loading in a certain factor in an orthogonal solution were included in the corresponding oblique factor, which in addition included a few other items. For the younger sample, the 7-factor solution showed the best correspondence between rotational methods, whereas for the older sample, the 7- and 8-factor solutions showed about equally good correspondence (for seven of the factors in the 8-factor solution). In general, the extra items included in the factors in the oblique solutions

made the factors less interpretable than the corresponding orthogonal factors. The intercorrelations between factors in the oblique solutions were generally low, about 50% being <.10 and the highest one being .25.

In conclusion, since orthogonal rotations yielded both simpler solutions and more meaningful factors, this rotational method was used throghout the study.

Factor analyses of data from the younger sample (11-25 weeks).

Preferred solution for the younger sample. Orthogonal solutions with six to nine factors were compared in terms of meaningfulness and stability across solutions. The 7-factor solution (see Table 1) was judged to yield the most meaningful interpretation. The stability of its seven factors across other orthogonal solutions was checked. In the 6-factor solution two of the factors were combined into one, whereas a new factor was added in the 8-factor solution, and in the 9-factor solution six of the factors were replicated. Thus, the 7-factor solution was chosen, since it was easiest to interpret and was stable both across rotational method and across different orthogonal solutions. This solution accounted for 34.2% of the variance.

Cross-validation of the 7-factor solution. The younger sample was randomly split into two subsamples, consisting of 180 and 201 cases. As a first step in the cross-validation procedure, exploratory factor analysis, extracting seven factors and using orthogonal rotation, was independently run on the two subsamples. As can be seen in Table 1, factors 2 to 6 were quite closely replicated, factor 1 was partly replicated and factor 7 was replicated in only one of the subsamples.

Insert Table 1 about here

As a second step, the 7-factor solutions of the two subsamples were each rotated according to the Procrustes procedure to fit the 7-factor solution of the total sample (see Table 1). The goodness of fit was checked by calculating coefficients of congruence (Gorsuch, 1974, p. 253) between the factors in the solution for the total younger sample and for each of the two subsamples. As can be seen in Table 1 the coefficients for corresponding factors indicated a considerable factor similarity. As could be expected from the results of the exploratory analysis the lowest value pertained to factor 7. None of the other factor combinations yielded any sizeable coefficients. As a further check of the adequacy of the procrustean rotation, the solution for the total sample and the procrustean rotated solutions for the subsamples were also compared in terms of differences between the matrices of factor loadings. The distribution of differences between the 7-factor solution for the total sample and the procrustean rotated solution in the first subsample yielded a mean of -.008 and a standard deviation of .095. Corresponding values for the second subsample were .007 and .060.

In conclusion, the cross-validation procedure showed that at least the first six factors of the 7-factor solution were stable enough to warrant interpretation.

Interpretation of factors. The first factor in the adopted solution consisted of items describing activity and intensity aspects of behavior in different situations. All items of the second factor dealt with regularity of different behaviors. The items of the third factor described reactions of like or dislike to strangers and to new situations and could be taken to measure the tendency to approach or withdraw. The three items of the fourth factor described intensity and endurance

aspects of behavior in frustrating situations and could be interpreted to measure frustration tolerance. The fifth factor seemed to measure sensory sensitivity, since the three items described strength of reaction to strong sound and light and to rapid movements. Factor 6 seemed to reflect attentiveness to various aspects of environmental stimulation since the questions concerned sensitivity to changes and to new aspects in the environment.

Factor analyses of data from the older sample (26-41 weeks)

Preferred solution for the older sample. Orthogonal solutions with six to nine factors were compared and were found to be quite similar. In the 6-factor solution two of the factors in the 7-factor solution were collapsed. The factors of the 7-factor solution were virtually identical to seven factors in the 8- and 9-factor solutions. In terms of meaningfulness, the last three solutions could be chosen.

Cross-validation. The total older sample was randomly split into two subsamples of 192 and 218 cases. Factor analyses extracting seven, eight, and nine factors, which were orthogonally rotated, were independently run on each subsample. An inspection of these solutions readily showed that the 8-factor solution was the most stable one across the two subsamples. As can be seen in Table 2, seven of the factors corresponded closely in the two subsamples and they also matched the first seven factors obtained for the total older sample.

Insert Table 2 about here

The 8-factor solutions for the two subsamples were then rotated to maximally fit the solution for the total sample using the Procrustes procedure. The relevant coefficients of congruence are presented in Table 2, where it can be seen that a good match was obtained at least for

the first seven factors. None of the remaining coefficients approached this magnitude. The distribution of differences between factor matrices for the total sample and for the subsamples yielded a mean of -.008 and a standard deviation of .073 for the first subsample. Corresponding values for the second subsample were .005 and .072.

To sum up, the 8-factor solution was considered the best solution for the older sample. This solution accounted for 37.0% of the total variance. The first seven factors were judged to be invariant enough to warrant interpretation.

Interpretation of factors and comparison between solutions for the younger and older samples. The first of the eight factors comprised items that had been interpreted to measure intensity and attentiveness aspects of behavior in the solution for the younger sample. Factor 2 was the regularity factor also obtained for the younger sample. Factor 3 was composed of items dealing with endurance and mood and had no counterpart in the solution for the younger sample. The fourth factor was a reduced version of the factor interpreted to reflect approach or withdrawal tendencies for the younger sample. Factor 5 was identical to the factor that in the solution for the younger sample was seen as reflecting sensory sensitivity, and the sixth factor consisted of items identified as activity items for that sample. The seventh factor was an extended version of the somewhat unstable factor 7 obtained for the younger sample. Since all its items concerned reactions to new food it was considered too specific to be seen as reflecting a general behavioral tendency.

In conclusion, the main difference between the solutions for the two different age groups was that the frustration factor in the solution for the younger sample had disappeared in the older sample, where instead

a factor reflecting endurance and mood appeared. The rest of the factors in the two solutions reflected the same aspects of behavior, but a regrouping had occurred. Whereas intensity and activity were combined in one factor and attentiveness appeared as a separate factor in the solution for the younger sample, intensity and attentiveness were combined in the older sample, with activity being a factor on its own. To check the similarity between the two solutions a procrustean rotation of the 8-factor solution for the older sample was executed with the 7-factor solution for the younger sample as the target matrix. The coefficients of congruence between the corresponding factors in the solutions for the two age groups were .90 or above for the first three factors, around .80 for factors 5 to 7, and as low as .58 for the fourth factor, the factor reflecting frustration reactions. The distribution of differences between the factor matrices had a mean value of .009 and a standard deviation of .108. It was concluded that the preferred solutions for the two different age groups were similar enough to warrant a combination of the two samples in order to explore the possibility of finding a solution applicable to the total age range.

Combination of the two samples aged 11-25 weeks and 26-41 weeks.

The two age groups were combined to yield a sample of 791 subjects. Exploratory factor analyses, extracting seven and eight orthogonally rotated factors, were executed. The important difference between the two solutions was that the frustration factor appeared in the 8-factor solution, but not in the 7-factor solution. The frustration factor included only two items and appeared as number eight of the eight factors. Since this factor previously had been shown to have a fairly weak representation in the older age group, it was not considered stable enough to be included in a final solution. In the 7-factor solution, one of the frustration items, which concerned intensity of behavior in

frustrating situations, belonged to the more general Intensity/Activity factor. Otherwise the two solutions were almost identical. A few extra items were added to one of the factors in the 8-factor solution; these items, however, also loaded in another factor and made the solution less interpretable. Thus, the comparison favored the 7-factor solution, which accounted for 33.6% of the total variance.

As a means of confirming the adequacy of the 7-factor solution for the combined sample to represent each of the solutions for the two age groups, these solutions were rotated according to the Procrustes procedure to maximally fit the solution for the combined sample. The results, together with coefficients of congruence, are presented in Table 3, which shows that a fairly good fit was obtained. The coefficients of congruence for other factor combinations were all considerably lower. The distribution of differences between factor matrices had a mean of -.003 and a standard deviation of .079 in the comparison of the younger age group with the combined sample. Corresponding values for the older sample were .002 and .069.

Insert Table 3 about here

From the above comparisons it was concluded that the 7-factor solution for the combined sample could be considered representative for the two different age groups. Thus, one factor solution could be used to describe behavior in infants aged 11 to 41 weeks. This final solution with verbal descriptions of each item, factor loadings, and communalities is presented in Table 4. The communalities indicate that many of the items have a great proportion of unique variance. Nevertheless, since the replicability of the factors has been shown to be good across rotational methods, solutions with varying numbers of extracted factors, and age

groups, it can be concluded that these items still constitute measures of the proposed dimensions.

Insert Table 4 about here

Interpretation of factors. The first five factors were easily identified as being the same as previously interpreted factors, reflecting intensity and activity aspects of behavior, regularity of certain behaviors, approach-withdrawal tendencies, sensory sensitivity, and attentiveness. Factor 7 was the previously identified factor concerning reactions to new food, which was considered too specific to be seen as a broad behavioral dimension. The sixth factor consisted of items describing mood, endurance, activity, and acceptance of new situations. For this factor no clear interpretation in terms of a general behavioral tendency could be formulated. Tentatively, the factor was interpreted as reflecting the parent's perception of the manageability of the child.

Thus, five broad dimensions of functioning were identified. These dimensions were named Intensity/Activity, Regularity, Approach-Withdrawal, Sensory Sensitivity, and Attentiveness.

DISCUSSION

The present study sought to answer questions about individuality in infancy by applying factor analytic procedures on behavior data obtained with a questionnaire technique. The results showed that individual differences in specific infant behaviors can be described in broader dimensions of functioning. Furthermore, it was concluded that the same dimensions are represented in the behavioral repertoire of infants aged 11 to 25 weeks and 26 to 41 weeks.

The final solution, that was considered representative for both age groups, contained seven factors. Of these, at least five could

readily be interpreted as broad dimensions of infant behavior. The conceptual status of the remaining two factors is less clear. One of them concerned behaviors in a specific situation (reactions to new food) and therefore does not seem to fit the notion of a dimension of functioning in the present sense of the term. The other factor concerned behaviors in various situatiors, but an underlying dimension of functioning is not easily discerned. A definitive conclusion about the conceptual status of this dimension must await further research. For the time being, a tentative interpretation in terms of parental attitude rather than infant functioning has been suggested.

The seven factors extracted in the final solution account for a third of the total variation in infant behavior as defined by the questionnaire. This is comparable to other studies; Garside et al. (1975) report 33%, Rowe & Plomin (1977) 36%, and Cohen et al. (1977) 42.8% of the variance accounted for. This means that there is a great deal of unique variance in the behavior of young children that cannot be accounted for by a description of individual differences in terms of broad dimensions of functioning.

Since about two thirds of the questionnaire items in the main study originated from the ITQ (Carey, 1970), a comparison between the five dimensions of functioning obtained in the present study and the nine dimensions of the NYLS as measures by the ITQ is feasible. Such a comparison shows that the Regularity and Rhythmicity dimensions in the two studies are identical. The other four dimensions of the present study all exhibit a clustering of items that does not fully agree with the ITQ scoring criteria. In spite of this, similarities in content between dimensions in the two studies can be found, so that the Intensity/ Activity factor is seen as reflecting the dimensions of Intensity of

Reaction and Activity Level in the NYLS. Likewise, there is equivalence between the Approach-Withdrawal dimensions of the two studies. The other two factors, Sensory Sensitivity and Attentiveness, may be said to tap the content of the NYLS dimension of Threshold. Thus, the content of five of the NYLS dimensions were reflected in the obtained factors. Two dimensions, Rhythmicity and Approach-Withdrawal, showed a direct correspondence of content; in the remaining cases contents of the NYLS dimensions were clustered or split in the obtained factors. These results may be taken to confirm the existence of some of the general behavioral tendencies in infant behavior delineated by the NYLS. On the other hand, except in the two cases mentioned above, the present results do not provide empirical support for the way these behavioral tendencies are structured into dimensions by the NYLS. The general difficulty with content analysis as a means of establishing dimensions of functioning is illustrated by a comparison between the interpretations of some of the obtained factors and the behavioral content that the separate items are intended to express when used in the ITQ. The obtained grouping of items suggests that the general behavioral tendency reflected in a specific item is not always immediately apparent from its verbal formulation. For example, the questions concerning the intensity of reaction to various kinds of sensory stimulation constitute a separate factor in the present study. This implies that these items do not tap the general intensity aspect of behavior as is intended in the ITQ, but rather the responsiveness, and thus perhaps the sensitivity, to sensory stimulation.

Results of other factor analytic studies, although in most cases concerning older preschool children, may be seen as supporting the significance of some of the dimensions established in the present study.

Several authors report the finding of an activity and/or intensity dimension (Bell et al., 1971; Chamberlin, 1977; Cohen et al., 1977; Garside et al., 1975; Rowe & Plomin, 1977; Scholom, 1975). The approach-withdrawal patterns of behavior are also reflected in some studies (Bell et al., 1971; Chamberlin, 1977; Cohen et al., 1977; Garside et al., 1975; Rowe & Plomin, 1977; Scholom, 1975). Garside et al. (1975) identified a dimension of irregularity which contains approximately the same behaviors as the Regularity dimension of the present study. Scholom (1975), working with infants, found regularity to be part of a more general consistency dimension.

Activity is a recurrent dimension also in studies using other than factor analytic methods for establishing dimensions of behavior in infants and preschool children (e.g. Birns, Barten & Bridger, 1969; Escalona, 1968; Fries, 1944; Schaefer & Bayley, 1963). An intensity dimension is also often found (e.g. Bridger & Birns, 1968). Perceptual sensitivity (Escalona, 1968), sensitivity (Birns et al., 1969), sensory sensitivity (Korner, 1971) are concepts used to account for behaviors subsumed in the factors of sensory sensitivity and attentiveness in the present study. Moreover, the Approach-Withdrawal dimension of the present study might well be the antecedent of dimensions concerning social behavior postulated by several authors (e.g. Escalona, 1968; Scarr, 1969; Wilson, Brown & Matheny, 1971).

In spite of the fact that the five dimensions of functioning obtained in the present study are in accord with recent research results in the realm of individual differences in children, the exhaustiveness of the obtained dimensional structure can be questioned. For instance, a frustration factor, that was not reflected in the final solution, appeared in solutions for the younger and for the combined sample. There are also

of parents´ ratings will be presented. For the time being, we will have to abide with McInerny´s and Chamberlin´s (1978) conclusion, after discussing attempts to validate checklists for somewhat older children, that moderate reliability and validity can be achieved by using parent reports.

dimensions of infant behavior, described by other investigators, that were not directly identified in the present work. Examples of such dimensions are cuddliness (Korner, 1971; Schaffer & Emerson, 1964), emotionality (Rowe & Plomin, 1977), soothability (e.g. Birns et al., 1969; Korner, 1971; Rowe & Plomin, 1977), and irritability (e.g. Birns et al., 1969; Korner, 1971; Wilson, Brown & Matheny, 1971). Whether these are separate dimensions missed because relevant aspects of infant behavior were not included in the questionnaire items cannot be decided at present. It should be pointed out, however, that Schaffer and Emerson (1964) suggested that the cuddler-noncuddler distinction might be explained in terms of activity level. This implies that the cuddliness dimension might be subsumed under the obtained Intensity/Activity dimension. Finally, it is possible that the factor tentatively named Manageability in the present study is a somewhat indirect representation of an irritability dimension of functioning.

The question of validity of indirect observation techniques like interviews and questionnaires is crucial to the present findings. Do the dimensions obtained in the present work and in other studies reflect actual behavior or are they merely expressions of parental beliefs and expectations? Thomas et al. (1963) attempted to validate the NYLS interview method by using direct observation of 23 children in their respective homes. Unfortunately, no detailed results for the various dimensions were reported, but the authors concluded that the validity of their method was satisfactory. Carey (1970) compared his ITQ results with those of the NYLS and found equivalence between behaviors measured and results reported with the two techniques. The problems of validity of the questionnaire used in the present study will be discussed elsewhere and a solution to the problems of investigating the validity

REFERENCES

Bell, R. Q., Weller, G. M., & Waldrop, M. F. Newborn and preschooler: Organization of behavior and relations between periods. Monographs of the Society for Research in Child Development, 1971, 36 (1-2, Serial No. 142).

Birns, B., Barten, S., & Bridger, W. H. Individual differences in temperamental characteristics of infants. Transactions of the New York Academy of Sciences, 1969, 31 (8, Serial No. 2).

Bridger, W.H., & Birns, B. Experience and temperament in human neonates. In G. Newton & S. Levine (Eds.), Early experience and behavior. Springfield: Thomas, 1968.

Buss, A., & Plomin, R. A. Temperament theory of personality development. New York: Wiley-Interscience, 1975.

Carey, W. B. A simplified method for measuring infant temperament. The Journal of Pediatrics, 1970, 77, 188-194.

Chamberlin, R. W. Can we identify a group of children at age 2 who are at high risk for the development of behavior or emotional problems in kindergarten and first grade? Pediatrics (Suppl.), 1977, 59, 971-981.

Cohen, D. J., Dibble, E., & Grawe, J. M. Parental style. Mothers' and fathers' perceptions of their relations with twin children. Archives of General Psychiatry, 1977, 34, 445-451.

Escalona, S. E. The roots of individuality. Chicago: Aldine, 1968.

Fries, M. E. Psychosomatic relationships between mother and infant. Psychosomatic Medicine, 1944, 6, 159-162.

Garside, R. F., Birch, H., Scott, D. McL., Chambers, S., Kolvin, I., Tweddle, E. G., & Barber, L. M. Dimensions of temperament in infant school children. Journal of Child Psykology and Psychiatry, 1975, 16, 219-231.

Gorsuch R.L. Factor analysis. Philadelphia: W.B. Saunders Company, 1974.

Kagan, J. The distribution of attention in infancy. In D.A. Hamburg, K. H. Pribram, & A. J. Stunkard (Eds.), Perception and its disorders. Baltimore: Williams & Wilkins, 1970.

Korner, A. F. Neonatal startles, smiles, erections, and reflex sucks as related to state, sex, and individuality. Child Development, 1969, 40, 1039-1053.

Korner, A. F. Individual differences as birth: Implications for early experience and later development. American Journal of Orthopsychiatry, 1971, 41, 608-619.

McInerny, T., & Chamberlin, R. W. Is it feasible to identify infants who are at risk for later behavioral problems? The Carey Temperament Questionnaire as a prognostic tool. Clinical Pediatrics, 1978, 17, 233-238.

Nie, N. H., Hull, H. C., Jenkins, J. G., Steinbrenner, K., & Bent, D. H. Statistical package for the social sciences (2nd ed.). New York: McGraw-Hill, 1975.

Rowe, D. C., & Plomin, R. Temperament in early childhood. Journal of Personality Assessment, 1977, 41, 150-156.

Scarr, S. Social introversion-extraversion as a heritable response. Child Development, 1969, 40, 823-832.

Schaefer, E. S., & Bayley, N. Maternal behavior, child behavior, and their intercorrelations from infancy through adolescence. Monographs of the Society for Research in Child Development, 1963, 28 (3, Serial No. 87).

Schaffer, R. Mothering. Glasgow: William Collins Sons & Co, 1977.

Schaffer, H. R., & Emerson, P. E. Patterns of response to physical contact in early human development. Journal of Child Psychology and Psychiatry, 1964, 5, 1-13.

Scholom, A. H. The relationship of infant and parent temperament to the prediction of child adjustment. (Doctoral dissertation, Michigan State University, 1975) Dissertation Abstracts International, 1975, 36, 4708B.

Stone, L. J., Smith, H. T., & Murphy, L. B. The competent infant. London: Tavistock Publications, 1973.

Thomas, A., & Chess, S. Temperament and development. New York: Brunner /Mazel, 1977.

Thomas, A., Chess, S., & Birch, H. G. Temperament and behavior disorders in children. New York: New York University Press, 1968.

Thomas, A., Chess, S., Birch, H. G., Hertzig, M., & Korn, S. Behavioral individuality in early childhood. New York: New York University Press, 1963.

Wilson, R. S., Brown, A. M., & Matheny, A. P. Emergence and persistence of behavioral differences in twins. Child Development, 1971, 42, 1381-1398.

Table 1

Factor loadings ≥.30 in the preferred solution for the total younger sample and loadings for the same items in the cross-validation analyses.

			Independent rotation		Procrustes rotation	
			Subsample		Subsample	
	Item No	Tot. sample	1	2	1	2
Factor 1	25	.59	.35	.67	.52	.63
	21	.49	.44	.36	.54	.41
	49	.49	.39	.41	.49	.47
	24	.46	-	.62	.42	.56
	39	.44	.53	.39	.48	.44
	19	.43	-	.40	.37	.40
	52	.41	-	.26[x]	.33	.51
	16	.41	-	.46	.45	.33
	41	.37	.48	-	.45	.29[x]
	37	.33	.26[x]	-	.43	.29[x]
	42	.34	-	-	.38	.29[x]
Coeff. of congruence[xx]					.95	.96
Factor 2	2	.82	.79	.81	.77	.82
	1	.80	.75	.86	.73	.87
	11	.57	.63	.49	.63	.51
	23	.41	.42	.41	.42	.41
	54	.40	.55	.28[x]	.54	.29[x]
	12	.35	.44	.30	.43	.31
	45	.30	.46	-	.42	-
Coeff. of congruence[xx]					.97	.97
Factor 3	44	.67	.54	.57	.59	.64
	40	.61	.52	.56	.60	.59
	6	.38	.30	.44	.35	.46
	14	.35	.26[x]	.34	.32	.34
	31	.33	.42	.39	.36	.35
	38	.31	-	.34	-	.37
	32	.31	.32	.39	-	.35
Coeff. of congruence[xx]					.91	.96

Table 1 - Continued

			Independent rotation		Procrustes rotation	
			Subsample		Subsample	
	Item No	Tot. sample	1	2	1	2
Factor 4	51	.70	.45	.68	.60	.67
	50	.60	.42	.58	.62	.56
	10	.33	-	.34	.31	.34
Coeff. of congruence [xx]					.86	.94
Factor 5	34	.78	.56	.76	.56	.57
	35	.58	.49	.64	.40	.58
	36	.54	.49	.58	.39	.63
Coeff. of congruence [xx]					.80	.96
Factor 6	42	.53	.73	.63	.57	.54
	47	.50	.30	.47	.46	.47
	43	.39	.47	.51	.33	.44
	46	.39	.30	.44	.35	.42
	37	.37	.54	.43	.27[x]	.36
	45	.35	-	-	.39	.31
Coeff. of congruence [xx]					.85	.95
Factor 7	15	.59	-	.59	.41	.57
	17	.57	-	.59	.39	.54
Coeff. of congruence [xx]					.75	.92

[x] Loadings $\geq .25$ and $< .30$

[xx] Based on all 54 items

Table 2

Factor loadings ≥.30 in the preferred solution for the total older sample and loadings for the same items in the cross-validation analyses.

			Independent rotation		Procrustes rotation	
			Subsample		Subsample	
	Item No	Tot. sample	1	2	1	2
Factor 1	37	.52	.56	.35	.48	.43
	39	.49	.53	.58	.48	.55
	42	.45	.47	-	.40	.34
	21	.42	.49	.46	.45	.44
	43	.40	.42	.33	.40	.36
	41	.37	.51	.30	.44	.29[x]
	25	.36	.39	.31	.45	.34
	9	.34	.29[x]	.32	.43	.31
	51	.33	-	.25[x]	.30	.31
	16	.32	.27[x]	.35	.27[x]	.33
Coeff. of congruence[xx]					.96	.95
Factor 2	1	.77	.69	.78	.73	.79
	2	.74	.66	.72	.70	.73
	11	.55	.64	.50	.62	.50
	54	.54	.54	.52	.54	.52
	23	.33	.32	.32	.33	.33
	12	.32	.37	.32	.35	.32
Coeff. of congruence[xx]					.96	.98
Factor 3	47	.57	.66	.43	.64	.47
	45	.57	.63	.56	.65	.46
	4	.42	.42	.35	.42	.30
	20	.38	.42	.45	.39	.42
	30	.36	.58	-	.57	-
Coeff. of congruence[xx]					.97	.85

Table 2 - Continued

			Independent rotation		Procrustes rotation	
			Subsample		Subsample	
	Item No	Tot. sample	1	2	1	2
Factor 4	44	.73	.71	.75	.64	.72
	40	.65	.68	.68	.65	.64
	31	.47	.40	.34	.43	.41
	30	.41	-	-	.52	.32
Coeff. of congruence [xx]					.97	.95
Factor 5	36	.71	.73	.62	.70	.66
	34	.61	.58	.64	.56	.63
	35	.57	.58	.54	.56	.55
Coeff. of congruence [xx]					.91	.95
Factor 6	52	.61	.50	.62	.48	.63
	49	.53	.54	.52	.48	.50
	19	.44	.38	.46	.43	.44
	24	.43	.31	.45	.27[x]	.44
	25	.39	.27[x]	.42	.25[x]	.42
Coeff. of congruence [xx]					.88	.91
Factor 7	15	.64	.63	.59	.61	.58
	17	.58	.45	.68	.46	.68
	16	-.38	-.38	-.36	-.40	-.40
	13	-.37	-.46	-.26[x]	-.39	-.29[x]
Coeff. of congruence [xx]					.91	.91
Factor 8	3	.40	-	-	.46	.32
	27	.37	-	-	.40	-
	28	.37	-	-	-	.26[x]
	26	.36	-	-	.34	-
Coeff. of congruence [xx]					.82	.78

[x] Loadings $\geq .25$ and $< .30$

[xx] Based on all 54 items

Table 3

Factor loadings ≥.30 in the preferred solution for the combined sample and loadings for the same items in the Procrustes rotated solutions for the younger and older samples.

	Item No	Combined sample	Procrustes rotation Younger sample	Older sample
Factor 1	39	.49	.46	.48
	25	.49	.42	.47
	21	.48	.48	.48
	41	.41	.35	.49
	48	.39	.36	.33
	49	.39	.41	.35
	16	.36	.31	.36
	24	.34	.29[x]	.35
	51	.32	.54	-
	19	.31	.34	.29[x]
Coeff. of congruence[xx]			.96	.93
Factor 2	1	.80	.81	.77
	2	.79	.82	.74
	11	.53	.55	.52
	54	.44	.40	.52
	23	.36	.41	.33
	12	.32	.34	.29[x]
Coeff. of congruence[xx]			.99	.98
Factor 3	44	.68	.55	.71
	40	.61	.54	.62
	32	.40	.35	.40
	31	.39	.29[x]	.50
Coeff. of congruence[xx]			.88	.96
Factor 4	36	.64	.55	.67
	34	.63	.75	.58
	35	.61	.57	.56
Coeff. of congruence[xx]			.96	.96

Table 3 - Continued

	Item No	Combined samples	Procrustes rotation Younger sample	Older sample
Factor 5	42	.58	.58	.33
	52	.46	.23[x]	.26[x]
	37	.45	.46	.33
	43	.42	.39	.20[x]
	9	.40	.27[x]	.25[x]
	46	.38	.26[x]	.27[x]
Coeff. of congruence[xx]			.86	.79
Factor 6	20	.46	.22[x]	.45
	45	.42	.41	.43
	6	.37	.35	.36
	3	.37	-	.48
	19	-.33	-.27[x]	-.33
	28	.33	-	.40
	7	.32	-	.31
	47	.32	.42	.39
	31	.30	.34	.26[x]
	24	-.30	-.34	-.27[x]
Coeff. of congruence[xx]			.86	.97
Factor 7	15	.68	.57	.62
	17	.57	.51	.54
	13	-.39	-.28[x]	-.46
Coeff. of congruence[xx]			.85	.94

[x] Loadings $\geq .25$ and $< .30$

[xx] Based on all 54 items

Table 4

Items with loadings ≥.30 in the preferred solution for the combined younger and older sample.

Factor Name	Item No	Description	Scale End-points	Loading	Communality
1. Intensity/ /Activity	39	Intensity of reactions to familiar persons	high-low	.49	.30
	25	" " " during bath	"	.49	.34
	21	" " " " diaper changing	"	.48	.24
	41	Intensity of reactions to strangers	"	.41	.17
	48	Mood during play	pos.-neg.	.39	.25
	49	Activity during play	high-low	.39	.24
	16	Intensity of reactions to new food	"	.36	.26
	24	Activity during bath	"	.34	.27
	51	Intensity of reactions to frustration	"	.32	.21
	19	Activity during diaper changing	"	.31	.27
2. Regularity	1	Regularity in times of falling asleep	reg.-irreg	.80	.66
	2	" " " " waking up	"	.79	.65
	11	" " " " wanting to be fed	"	.53	.31
	54	" " " " being awake and alert	"	.44	.22
	23	" " " " bowel movements	"	.36	.15
	12	" " amount of food intake	"	.32	.17
3. Approach- -Withdrawal	44	Mood when carried by a stranger	pos.-neg.	.68	.58
	40	" " first meeting a stranger	"	.61	.48
	32	" " examined in child health center	"	.40	.20
	31	Adaptability in new situations/places	rapid-slow	.39	.27
4. Sensory Sensitivity	36	Intensity of reactions to rapid movements	high-low	.64	.43
	34	" " " " strong sounds	"	.63	.40
	35	" " " " sharp light	"	.61	.39
5. Attentiveness	42	Differential reactions to adults and children	yes-no	.58	.40
	52	Mobility when placed on floor/bed	high-low	.46	.38
	37	Differential reactions to different voices	yes-no	.45	.31

cont.

Table 4 - Continued

Factor Name	Item No	Description	Scale End-points	Loading	Communality
5. Attentiveness (cont.)	43	Reactivity to physical differences in people	high-low	.42	.24
	9	" " feeding preparations	"	.40	.24
	46	Acceptance of new toy	rapid-slow	.38	.18
6. Manageability	20	Mood during diaper changing	pos.-neg.	.46	.25
	45	Persistence in self-amusement	high-low	.42	.28
	6	Adaptability of sleeping habits in new places	"	.37	.21
	3	Mood before falling to sleep	pos.-neg.	.37	.20
	19	Activity during diaper changing	high-low	-.33	.27
	28	Mood when being dressed in out-door clothing	pos.-neg.	.33	.16
	7	Sensitivity to sounds when asleep	high-low	.32	.13
	47	Persistence when playing with toy	"	.32	.26
	31	Adaptability in new situations/places	"	.30	.27
	24	Activity during bath	"	-.30	.27
7. Reactions to New Food	15	Acceptance of new food	rapid-slow	.68	.48
	17	Adaptability to new food	"	.57	.38
	13	Sensitivity to differences in taste	high-low	-.39	.23